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ORIGINAL MEMOIRS.

FINAL RESULTS IN THE X-RAY TREATMENT OF CANCER, INCLUDING SARCOMA.¹

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SINCE February, 1902, or a period of over three years, I have made an earnest endeavor to determine the value of the X-ray in the treatment of malignant tumors.

At the beginning of this period there had been published a few reports of remarkable cases of cancer that had disappeared after a few weeks' or months' treatment with the X-ray. While most of these cases were of the cutaneous variety, or superficial epitheliomas, there were, in addition, a number of cases of recurrent cancer of the breast and two cases of inoperable sarcoma of the neck.

These reports gave rise to the hope that in the X-ray we had at least found something that offered relief, and perhaps cure, to that large class of patients afflicted with recurrent inoperable cancer, and possibly offered to patients suffering with primary cancer in the earlier stages, a larger prospect of cure than surgical operation.

Until it had been demonstrated that these apparently successful cases had remained free from recurrence sufficiently

¹ Read before the New York Surgical Society, May 10, 1905.

long to entitle them to be called cures, I then believed, and have since maintained, that the treatment should be strictly limited to inoperable and recurrent cancer, or applied as a postoperative measure that might possibly render recurrence less likely to take place.

The after-histories of these cases apparently successfully treated by the X-rays has proven the wisdom of such a course.

At the General Memorial Hospital, in February, 1902, through the liberality of Mrs. Collis P. Huntington and Mr. Archer M. Huntington, two X-ray machines were installed, and the work has been maintained up to the present time under the charge of Mr. W. P. Agnew and Dr. James Ogilvie, who have treated the cases under my direction during this period.

During this time there have been treated, including a few cases treated by myself personally outside of the hospital, 176 patients, as follows: 68 cases of sarcoma; 36 of carcinoma of the breast; 44 of epithelioma of the head, face, and neck, including tongue; 14 of deep-seated abdominal growths, probably carcinoma; 5 not classified; 3 of tubercular glands of the neck; 3 of Hodgkin's disease; 3 of lupus.

This gives us 167 cases of malignant tumors, sarcoma or carcinoma, in a total of 176 cases.

In five of the sixty-eight cases of sarcoma complete disappearance was observed, but in every one of these cases there was a recurrence a few months later. In two of these cases the recurrent growths disappeared again under the combined X-ray and toxin treatment. These two cases are still well at present. Of the other cases one died of internal metastases, one a sarcoma of the pectoral region and axilla was a local recurrence; the fifth case, a sarcoma of the chest-wall, involving the ribs and pleura, disappeared under the combined treatment with the X-rays and toxins, the X-rays having never been used alone. In this case there has recently been a recurrence which thus far has not yielded to further treatment with the X-rays or toxins.

In one case, a very rapidly growing sarcoma of the orbit with extensive involvement of the lymphatic glands of the

neck, very marked improvement followed the use of the X-rays, the glands of the neck nearly disappearing under a few weeks' treatment, and the tumor of the orbit also diminishing in size. The improvement, however, was of very brief duration; the tumor soon began to increase again rapidly and caused death in a few months.

The X-rays were used in three cases of melanotic sarcoma, starting in the skin of the ankle in two cases, and involving the femoral and iliac glands. In one case the X-rays were used for nearly two years, and seemed to have a decided influence in retarding the progress of the disease; in the other two, which were of much more rapid growth, the effect was apparently *nil*.

After having given the X-ray a very careful trial in sixty-eight cases of sarcoma in almost every locality, I am forced to the conclusion that, while in certain rare cases, especially of sarcoma originating in the lymphatic glands, improvement may be very striking, going so far, in some cases, as to cause entire disappearance, there is almost always a speedy recurrence, either local or metastatic, and that the influence of the X-rays upon sarcoma is rarely, if ever, curative. The case of Skinner may prove the single exception to this rule, although sufficient time has not yet elapsed to justify us in considering it a cure. (See elsewhere.)

The following is a brief history of the cases of sarcoma that disappeared under the influence of the X-ray or the X-ray and toxins combined, traced to final results:

CASE I.—*Extensive Recurrent Round-celled Sarcoma of the Neck, Both Sides, Superior and Infraclavicular, Pectoral and Axillary Regions on One Side, and Mediastinal Glands.*—The early history of this case is given in full in the *Transactions of the American Surgical Association*, 1902. The patient, M. A., aged forty-five years, was confined to bed and in such a hopeless condition that she was not expected to live more than two months. The toxins had been used with improvement at first, and finally abandoned. On February 10, 1902, at the General Memorial Hospital, I began the X-ray treatment purely as an experiment. The

improvement was more striking and rapid than in any other case that I have observed. The tumors steadily disappeared, and by July 1 there remained only a small nodule, the size of an almond, anterior to the sternomastoid muscle. This I removed under ether purely for pathological study, and the examination by Dr. George P. Biggs, of the New York Hospital, confirms the original diagnosis, and is of great interest. The patient regained her normal strength, and spent the summer in the country. She returned on September 24 with a local recurrence, the size of an English walnut, in front of the ear in the lower portion of the parotid. Both groins were filled with multiple tumors, varying in size from a hen's egg to that of a pigeon's egg. In addition, there was an intra-abdominal tumor, the size of two fists, smooth, globular, fairly movable, apparently originating in the ascending colon or its mesentery. There was undoubted constriction of the bowel at this point. Her condition again seemed hopeless. I resumed the X-ray treatment, and in three weeks the nodule in the parotid region had entirely disappeared, and the groin tumors disappeared within six weeks, and the growth in the abdomen decreased to about one-half its former size.

The treatment was kept up during the entire winter with steady decrease in the size of the abdominal tumor, and, continued in the summer of 1903, at Dartmouth, New Hampshire, under the general supervision of Dr. C. B. Nancrede. When the patient returned to me again in the fall, another nodule had appeared in the cervical region, the tumor in the abdomen seemed to be somewhat larger, and a few nodules were beginning to appear subcutaneously in the region of the thighs and abdomen. Her general health, too, had deteriorated. The X-ray treatment was again applied for a few weeks, but she grew worse very rapidly, new tumors appearing almost every day. Towards the end she suffered a great deal of pain in the sciatic and crural nerves. She died in June, 1904. At the time of her death, in addition to a large tumor in the abdomen, there were hundreds of nodules varying in size from a pea to a small egg, situated in the subcutaneous tissue and scattered over the entire body. One of these nodules was removed and examined at the Loomis Laboratory by Dr. B. H. Buxton. Examination showed it to be the same type of growth as all of the other specimens, namely, small round-celled sarcoma, apparently very little changed by the treatment.

CASE II.—*Small Round-celled Sarcoma of the Pectoral Region*.—E. M., aged thirty-five years. Family history good. Had been twice operated upon for round-celled sarcoma of the right pectoral region by Dr. Maurice H. Richardson, of Boston, and a microscopic examination made by Dr. W. F. Whitney at the Massachusetts General Hospital proved the growth to be round-celled sarcoma. The last operation was performed in October, 1901. The disease then involved the pectoral and axillary regions so widely that it was impossible to make a complete removal. Amputation of the upper extremity was considered, but not thought advisable. The patient was referred to me by Dr. Richardson in October, 1901. The mixed toxins were administered five to six times a week for three months in doses sufficient to produce a marked reaction. The tumor softened, and in January, 1902, a spontaneous opening occurred, with evacuation of about a pint of necrosed tumor tissue, as a result of which the growth was reduced about two-thirds. In February, 1902, the X-rays, plus toxins, were administered, causing continued decrease in the size of the tumor. In June, 1902, the growth had entirely disappeared, and the patient returned to Rhode Island in good condition. He worked hard every day and gained twenty pounds in weight. An examination, January 5, 1903, showed the patient's general condition still perfect, but about two inches below the clavicle, in the pectoral region, there was a small movable nodule the size of a hickory-nut. He returned to the General Memorial Hospital on February 3, 1903, for the combined toxin and X-ray treatment, with the result that in six weeks the recurrent tumor had again disappeared, his general health remaining perfect.

This case was shown before the meeting of the American Surgical Association in June, 1903. In December, 1903, the patient had a slight local recurrence, which disappeared under renewed X-ray and toxin treatment. He remained well until the early part of 1904, when he had a local return, which has never entirely disappeared. The patient has been able to attend to his regular duties up to the present time. In a letter of May 31, 1905, he stated that he was working every day, and that his condition had remained about the same since I saw him a year ago, since which time he had gone entirely without treatment. On July 5, 1905, I examined him, and found him with extensive local

recurrences and evidences of extension into the lung and pleura. He was much emaciated, and his condition hopeless.

CASE III.—*Small Round-celled Sarcoma of the Back.*—W. J., aged eleven years. Family history good. In the latter part of August, 1901, the patient fell from a stoop, striking on his back. Two or three weeks later the mother noticed a swelling in the midscapular region, a little to the left of the median line. This swelling increased very rapidly. It was soft and fluctuating from its beginning. The patient was referred to me in December, 1901, by Dr. Polhemus, of Nyack, New York. Physical examination at that time showed a cystic swelling the size of an orange in the left scapular region. The skin was normal, the tumor fluctuating, situated apparently just beneath the skin and superficial fascia. On January 12, 1902, an incision was made under ether and several ounces of dark blood were evacuated. There was no evidence of any solid tumor at this time. The wound closed without drainage and healed by primary union. About three weeks later a tumor began to develop at the original site; this was also cystic in character, increased rapidly in size until May, when it had become one-third larger than at the first operation. I then operated again under ether anæsthesia, finding at this time, in addition to fluid blood and clots, such a thickening of the walls of the cyst as to make me suspicious of sarcoma. A portion of this thickened tissue was removed and examined by Dr. H. T. Brooks, Professor of Pathology at the Post-Graduate Hospital, who pronounced it small round-celled sarcoma of high vascularity. Two weeks after the operation and before the wound had entirely healed, the X-ray treatment was begun and continued three times a week. The treatment was kept up the entire summer and fall of 1902. In December, 1902, there was well-marked evidence of local recurrence in and about the cicatrix. The tumor continued to increase in size in spite of X-ray treatment. On January 26, 1903, I operated a third time under ether anæsthesia and removed the recurrent tumor together with the old cicatrix. The wound healed by primary union. Shortly after he left the hospital, the X-ray treatments were resumed, and continued once or twice a week during all of 1903 and the first half of 1904. In June, 1904, there began to appear signs of another recurrence in the old cicatrix, and this time, in addition to the X-ray, I began the local injections of the mixed toxins of erysipelas and *Bacillus pro-*

digiosus. The injections have been continued from July 1 up to the present time, June 19, 1905, two or three times a week, with two X-ray treatments a week, with the result that the recurrence slowly disappeared, the ulcerated area healed over, and at the present moment there is no trace of a growth anywhere visible. The boy's general health has remained perfect up to the present time.

CASE IV.—*Round-celled Sarcoma of Femur involving the Lower Two-thirds of Shaft.*—A. G., aged nineteen years. A swelling was first noticed in the lower portion of the femur in November, 1901. This gradually increased in size, being accompanied by loss of weight and deterioration of general health. Physical examination on February 5, 1902, showed a large tumor extending from the condyles of the left femur to the junction of the middle and upper third. There was a fusiform enlargement of the entire lower two-thirds of the femur. On the outer aspect of the thigh, about one and one-half inches above the joint, there was a soft, fluctuating area just covered by thin and reddened skin. There was slight impairment of the functions of the joint itself. An incision was made under ether into the fluctuating area, and two to three ounces of clear serum, similar to that which is found in cystic degeneration of sarcomatous tissue, were evacuated. A curette was passed into the cavity of the bone and typically sarcomatous tissue removed. Microscopic examination by Dr. E. K. Dunham showed it to be a round-celled sarcoma. The patient absolutely refused amputation at the hip, which I strongly advised.

The X-ray treatment was tried entirely as an experiment, four exposures a week being given for a month, at the end of which time the circumference of the tumor had decreased one inch. The treatment was discontinued for two weeks, during which interval the tumor had again increased nearly an inch. The treatment was resumed, and at the end of another month the circumference of the thigh over the centre of the tumor was one inch less than the original measurement. The treatment was continued the entire summer to December, 1902. At this time the measurement of the left leg was the same as that of the right. There was still some thickening in the lower part of the femur. The old sinus, which had never healed after the exploratory incision, was enlarged under ether and carefully curetted. Examination of the

tissues failed to show any trace of sarcoma. The patient had gained twenty pounds in weight, but towards the end of December, 1902, began to show signs of a metastatic tumor developed in the left pectoral region; this grew rapidly until it became about the size of a hand, when it was partially removed under ether anæsthesia; it was found to be very soft and highly vascular. Shortly after this, a large tumor, the size of a child's head, developed in the right iliac fossa, extending from the costal cartilages down to the pelvis; it could be easily felt in the lumbar region. The local treatments with the X-ray in the femur and pectoral regions were continued, and in addition the mixed toxins of erysipelas and *Bacillus prodigiosus* were begun. After a few weeks the large tumor in the ilio-lumbar region began to soften and break down, and on becoming completely fluctuating was opened posteriorly. A very large amount of necrotic tumor tissue was evacuated and the sinus was drained for about a year. While the tumor in the leg had apparently disappeared, there remained a marked thickening of the bone, and the sinus leading to the broken-down area persisted. Examination of several curettings failed to show any longer evidence of sarcoma. At the present time, three and one-quarter years after beginning of treatment, aside from the sinus in the leg, the boy appears to be in perfect health. There is at present no evidence of sarcoma to be found.

CASE V.—*Inoperable Round-celled Sarcoma of the Chest-wall, Involving Ribs, treated by the X-rays combined with the Toxins of Erysipelas and Bacillus Prodigiosus.*—G. C., sixteen years of age, enjoyed good health up to 1903, when he had an attack of what was considered to be pleurisy with effusion. He was aspirated, but the dulness over the chest persisted, and he rapidly lost flesh and strength. He was sent south, without improvement, and in October, 1903, entered the Johns Hopkins Hospital, where he was operated upon for a supposed empyema. A large incision was made, revealing a necrosis of the eighth and ninth ribs, and behind these some gelatinous masses were found. These were partially removed and examined by Dr. Welch who pronounced them round-celled sarcoma. The patient was referred to me, and on May 26, 1904, was admitted to the General Memorial Hospital, where for two months the toxins were regularly administered; in addition, he received X-ray treatment

three times a week. At that time the patient was so weak that he could hardly walk. There was a mass about the size of a man's hand over the ribs, with an extensive, sarcoma-like sloughing area in the centre. The improvement was very rapid, and when he left the hospital in the fall of 1904 there was no trace of the tumor left; the patient had gained twenty-five pounds in weight and seemed in perfect health. He returned to his home in Canada, where his family physician had been instructed to continue the toxin treatment in smaller doses two to three times a week.

By the end of January, 1905, the patient returned to New York for examination, and there was evidence of a local recurrence, which at first again showed some improvement; after a few weeks, however, the tumor began to slowly increase in size in spite of large doses of the toxins and regular and prolonged X-ray treatment. The growth was thoroughly curretted in March and again on June 8. At the last operation a mass of soft, vascular sarcomatous tissue, about the size of a small orange, was scooped out with a large spoon from within the chest-wall. Hæmorrhage was very profuse, but was finally stopped by tight packing. After an infusion the patient rallied well from the operation. At present there remains an area of tumor tissue on all sides of the cavity, involving the bony structures as well as the soft parts and extending deeply into the lung. The prognosis seems hopeless.

CASE VI.—*Inoperable Intra-abdominal Sarcoma involving Mesentery, Mesenteric Glands, and a Portion of the Small Intestine, which disappeared entirely under Four Months' Treatment with the X-rays and Toxins combined.*—Mrs. W. was operated upon in November, 1903, by Dr. William M. Conant, of Boston, for abdominal tumor. It was thought to be connected with the uterus or ovary, but an infiltration into the small intestine was found. There was also in the posterior peritoneal part of the mesentery a growth fully as large as the closed fist. The growth was so extensive and suspicious that no attempt was made to remove it. Pathological examinations made by Drs. W. F. Whitney and A. C. Potter proved the disease to be round-celled sarcoma. The patient was then referred to me by Dr. Conant, and I began the combined X-ray and toxin treatment, with the result that the tumor entirely disappeared in four

months' time. After this the patient developed high temperature with acute abdominal symptoms, pointing to local peritonitis. She was desperately ill and all hope of life was abandoned for more than a week. A faecal fistula finally developed, and she slowly recovered her health. She is alive at present, one and a half years afterwards. In January, 1905, a small mass could be felt in the lower portion of the abdomen, at the site of the original tumor, and, as it increased slowly in size, the treatment was resumed by her former physician, Dr. W. E. Wilson, of Pawtucket. The growth has not again disappeared, though there has been improvement.

CARCINOMA OF THE BREAST.

The thirty-six cases of cancer of the breast treated by the X-ray furnish almost every variety of the disease, from the cancer "en cuirasse," with extensive lymphatic involvement and œdema of the arm, to the small, superficial, recurrent cancerous nodules along the site of the old cicatrices. In addition, the X-ray was used in four cases as a prophylactic immediately after operation for the primary growth. I regret to say that these cases furnish little encouragement for the use of the method as a prophylactic measure, since in every instance a recurrence took place within a few months, while the patient was still undergoing the treatment. While in one case there was no definitely recognized recurrence in the pectoral or axillary regions, the patient died of general metastases within a year's time. In two other cases, very small recurrent nodules, just beneath the skin in the neighborhood of the old cicatrix, disappeared after a few weeks' treatment, but in both cases there was a speedy return, and the treatment seemed to have little effect in checking the steady progress of the disease towards a fatal issue.

In one instance the X-ray was used in a primary operable tumor, presenting all the clinical appearances of carcinoma, although no microscopical examination was made. Every effort was made to induce the patient to submit to an operation, but she absolutely refused. She was told that the X-ray treat-

ment was purely experimental and probably would do no permanent good.

The patient, aged forty-five years, married, with negative family history, had a tumor in the right breast of about eight years' growth. No history of trauma. Examination made in April, 1902, showed a tumor of about the size of a large English walnut in the upper portion of the right breast. The tumor was very hard, the skin was adherent; axillary glands were not involved. The patient was given the X-ray treatment three times a week during the spring and summer of 1902, with the result that there was some decrease in the size of the tumor and increase in mobility. On discontinuing the treatment for a few months, the tumor again began to increase in size. She received intermittent treatment up to two months ago, and sometimes would go several months without any exposures. At present the tumor is about the same as it was three years ago. There is still no involvement of the axillary or mediastinal glands.

I do not feel absolutely sure that the case is carcinoma, although from the clinical appearances I have little doubt. If so, the disease has certainly been held in check for three years, although of late her general health is not so good, and she has had a severe bronchitis, which may be evidence of internal metastases.

In my entire experience with the X-ray, I have seen but one case of deep-seated carcinoma in which the tumor disappeared.

The patient, Mrs. M. D., forty years of age, married, no children, was suffering from a very extensive ulcerative carcinoma of the right breast which had destroyed the entire breast, involving periosteum of the ribs and sternum. The X-ray treatment was begun in December, 1902, and continued until May, 1903, during which time the disease apparently completely disappeared. The patient's general health remained good. About a year ago she had a severe attack of pleuritis, which was supposed to be an extension of the disease into the pleura and lung, and for a number of weeks she was not expected to live. She

gradually recovered her health, however, and for nearly a year has been able to be up and about. During this time there has been gradual extension of the disease into the other breast, which is now completely involved, and physical examination shows undoubtedly the presence of large deposits in the right lung, which cause her a good deal of dyspnoea on exertion. She has marked dilatation of the right pupil, and, after gradual diminution of vision, she is now totally blind on the right side. The X-ray treatment has been continued almost the entire time during the last year. At present she is up and about and goes out every day, although her general condition is gradually failing. She has recently developed slight facial paralysis.

In this case the X-ray has undoubtedly prolonged her life for a considerable period, although the tumor originally was of comparatively slow growth, having existed nearly three years prior to the beginning of the X-ray treatment.

EPITHELIOMA.

We have treated forty-four cases of epithelioma of the head, face, and neck. In this number are included cases of epithelioma originating in the lip or tongue, later involving the glands of the neck. Ten cases were epithelioma of the nose; ten superficial epithelioma of the face. In only four cases did the disease disappear entirely. In every case in which there was involvement of the glands of the neck, no improvement whatever was noticed, and the rays had little, if any, effect in retarding the disease. This was especially noted in tumors originating in the tongue or lip, showing that some of the very small epitheliomas of the face often fail to yield to X-ray treatment. I will cite one case of epithelioma involving a small area of the lower eyelid and the skin in the region of the inner canthus, which was treated for a period of seven months without disappearance. Another case, an epithelioma of the face, but little larger than a pea, but involving the deeper layers of the skin, showed no improvement after two months' treatment with the X-rays. The patient submitted to excision, which had been strongly advised at first.

The X-ray was used in four cases of carcinoma of the abdomen probably originating in the sigmoid or cæcum, and in one case of high rectal cancer with extensive involvement of the sigmoid. In the latter the growth decreased slightly in size and the pain was somewhat controlled by the X-ray treatment. His condition then grew worse and he died suddenly a short time later. It is very doubtful if his life was much prolonged by the treatment. In the other cases there has been no effect whatever upon the intra-abdominal growths.

Four cases of malignant disease of the larynx and one of the œsophagus showed absolutely no improvement under the treatment.

In one of the three cases of Hodgkin's disease treated with the X-ray, there was very remarkable improvement at first. The glands of the neck, axilla, and groin disappeared entirely, and the spleen, which was of enormous size, decreased to one-third of its original dimensions. However, after about six months the patient had a sudden attack of pain in the epigastrium, with vomiting and jaundice and moderate rise of temperature. The symptoms increased in severity and he died in two weeks. No autopsy. The second case of Hodgkin's disease was not traced, and a third is at present under treatment.

Of the three cases of lupus, the disease disappeared entirely in two and there was marked improvement in the third. In one of the cases of tubercular glands of the neck, the glands markedly decreased in size; in one they disappeared, and in the third case there was slight involvement.

CASES OF EPITHELIOMA OR CARCINOMA THAT DISAPPEARED UNDER X-RAY TREATMENT.

CASE I.—F. S., male, fifty-five years old. Superficial epithelioma of the forehead, about the size of a silver half-dollar, of thirty years' duration. Treatment was begun in March, 1902, and continued until April 6, 1903, when it was discontinued on account of a burn. At this time the growth itself had almost entirely disappeared. The patient was examined on May 1,

1905, three years after the beginning of the treatment, and was found perfectly well.

CASE II.—Mrs. S., sixty-three years of age. Small epithelioma of the forehead of seven months' duration. The treatment was begun in June, 1903, and kept up with intervals of rest until March 30, 1905. May 1, 1905, examination showed no return of the growth.

CASE III.—Mrs. A., aged thirty-four years. Small ulcer, one-half inch in diameter, situated upon the end of the nose, about one year's duration. In this case the clinical diagnosis was not positive, and it was believed that the ulcer was probably of syphilitic origin. It disappeared after one month's treatment, and examination nearly three years later, on May 1, 1905, shows no return of the trouble.

CASE IV.—Mrs. F., forty-nine years of age. Recurrent inoperable carcinoma of the cervix. First operation was done on September 22, 1901, by Dr. C. H. Fredericks, of the Woman's Hospital, at Buffalo. Reappearance of bloody discharge in April, 1902, at which time the case was considered inoperable by Dr. Jarman of the General Memorial Hospital. X-ray treatment begun May 5, 1902, and continued for about four months, at the end of which time the growth had entirely disappeared. The patient is well at the present time. In this case, unfortunately, no microscopical examination was made to confirm the clinical diagnosis. In view of the fact that the trouble disappeared after such a short period of treatment, the diagnosis of carcinoma cannot be regarded as positive. In fact, Dr. Fredericks writes me that he is inclined to think there was an error in diagnosis.

The only other case that remains well at the present time is the case of sarcoma of the femur already described, in which, six months after the X-ray treatment was begun, extensive metastases occurred in the pectoral region and iliac fossa. At this time he was placed upon the mixed toxins of erysipelas and *Bacillus prodigiosus*. The large tumor in the iliac fossa broke down and was evacuated. After long-continued treatment, the patient is at present well, without visible evidence of a return. This case can by no means as yet be regarded as a

cure, although, in view of the fact that so very few cases of periosteal sarcoma of the femur are cured even by hip-joint amputation, or life prolonged beyond two years, the case is of great interest.

I have made an effort to trace to final results certain reported successful cases of deep-seated malignant tumors treated by other men.

CASE I.—*Round-celled Sarcoma of the Neck*, treated by DR. C. E. SKINNER, of New Haven, and published by Dr. Frank A. Kirby (*Journal of Advanced Therapeutics*, February, 1902).

The patient, male, aged sixty-four years, three years ago received a blow upon the neck from a wagon-pole, leaving a contusion which lasted about a week. Two months later a swelling appeared at the site of the injury. This grew very slowly for about sixteen months, when the patient severely wrenched his neck. Almost immediately afterwards the tumor began to grow more rapidly, and became painful. By November, 1901, the tumor had become very large, and occupied the greater portion of the left mastoid and cervical region, measurements being seven inches laterally, ten inches vertically, with some ulceration and breaking down. Microscopic examination by Dr. Archibald McNeal, of the New Haven Board of Health, showed the tumor to be round-celled sarcoma. The X-ray treatment was begun November 20, 1901, by Dr. Skinner, a Van Houten and Tenbrook 32-inch twelve-plate static machine being used. Dr. Skinner states that in the incredibly short space of time of six weeks the patient was apparently cured, the tumor having disappeared, the surface healed, and the patient being free from pain, and able to resume his work.

On June 27, 1902, I made a personal examination of this case and found the following conditions:

In the left side of the neck and mastoid region is a very large, broad cicatrix, measuring two and one-half by three and one-half inches, but there is absolutely no trace of a recurrent growth. In the lower part of the cervical region there can be felt on deep pressure very slight enlargement of one or two of the deep cervical glands, apparently no longer than peas.

In a letter, received in the latter part of 1903, his physician states that the patient began to lose rapidly in general health, and died about five months later. No autopsy was made, but there is little doubt that his death was due to internal metastases.

CASE II.—Male, aged seventy years, with small round-celled sarcoma of the neck, six times recurrent, and apparently absolutely hopeless. The X-ray treatment was begun by Dr. E. R. Fiske, of Brooklyn, on December 22, 1901. A static machine was used daily, and exposures of ten minutes' duration were given the first few weeks; these were gradually lengthened to twenty minutes, and the treatment was continued, with occasional

intervals of rest, for a year. At the X-ray meeting of the Academy of Medicine, March 9, 1902, I showed the patient in perfect health, and there was not the slightest suspicion of tumor or induration in the neck. A communication from Dr. Fiske, dated January 23, 1903, states that the patient is free from recurrence, in fine health, and has gained in weight. In a later letter it is stated that he died on September 23, 1903, under symptoms of cerebral thrombosis. Here again there is strong probability that death was due to generalization of the disease.

The after-histories of two cases of malignant tumor that had been previously under my care and were later apparently successfully treated with the X-ray by Dr. William J. Morton, of New York, as reported in the *Medical Record* of March 8, 1902, are of interest:

One, a recurrent carcinoma of the breast, the size of a bean, disappeared under three weeks' treatment from January 30 to February 19, 1902, and is reported as cured except as to usual possibility of a recurrence. Two months later, however, this patient died of extension of the disease into the lung and pleura.

The other case was an extensive sarcoma of the mastoid region in which the mixed toxins had been tried and failed. At the time of the beginning of the treatment, January 25, 1902, there was a large bony tumor in front of the ear and a soft tumor, three by two inches in size, behind the ear. The patient suffered intense pain and was taking one-half grain of morphia every two to three hours. After a few treatments the pain ceased and both swellings decreased in size. At the time of the report, February 20, 1902, only a small lump of the soft tumor remained, and the pain had entirely ceased. Later, the X-ray lost its influence upon the disease, the patient's general health slowly deteriorated, and she died within three months after the case was reported.

In the *Johns Hopkins Bulletin*, June, 1904, p. 192, Professor E. Schiff, of Vienna, reports a case of cancer of the mamma cured by means of the Röntgen ray. The patient came to him on February 7, 1903, with an inoperable cancer of the left breast, extending from the edge of the sternum to the midaxillary region, 8 centimetres in width and 5 centimetres elevation, with an ulcerated surface and five small nodules in the back. The X-ray treatment was begun and marked improvement was noted

from the start. On June 5, or less than four months from the beginning of the treatment, the last record was made. At this time it is stated that "excepting some excoriated patches, a flat scar, crossed by some enlarged veins, had taken the place of the tumor; the cutaneous metastases had disappeared, the group of supra- and infraclavicular glands had decreased in size and become softened." This description of the condition makes it quite clear that the disease had not entirely disappeared. Inasmuch as there is no after-history of the case, there seems to be little warrant for reporting it cured.

In the *Beiträge zur klinischen Chirurgie*, vol. xxxvii, 1903, Mikulicz reports a case of deep-seated cancer of the male breast which apparently disappeared under the use of the X-rays. The case is briefly as follows:

The patient, a man fifty-two years of age, was admitted to the Breslau Clinic on July 23, 1902, suffering from an ulcerating tumor of the left breast, claimed to be due to an injury sustained two years previously. The diagnosis of carcinoma of the breast with metastases in the glands of both axillæ was made. It was decided to clean out the axillæ and treat the breast ulcer with the X-rays. The operation was performed on July 1, 1902. Microscopic examination of the piece of the breast tumor that had been excised for this purpose showed it to be a simple mammary carcinoma. The axillary glands, too, proved to be extensively infiltrated by the disease. The X-ray treatment was begun on the 2d of July. By the end of the month the ulcer had decreased from 7 by 3 centimetres to 5 by 1½ centimetres. A piece was then excised in the neighborhood of the former excision and examination showed no carcinomatous cell present. The patient was discharged on the 2d of August, and examination on October 22 showed a smooth scar, pink, soft, and movable. No indurated tissue below or around the scar nor in the axillary cavity.

In a later paper (*Beiträge zur klinischen Chirurgie*, Band xliii, p. 505), Mikulicz gives a complete *résumé* of his results obtained from the use of the X-ray in cancer. He reports thirty-seven cases: of these eighteen were carcinoma of the skin, two of the buccal cavity, one of the lymph-glands of the neck, five of the œsophagus, and eleven of the breast. In the latter series we also find the later history of the above cited case. It is there stated that two months later the scar had reopened, evidently as a result of maceration due to inefficient bandages; no local recurrence; but outside of the exposed area, near the axilla, a hard nodule, the size of a bean, was found. Extirpation and closure of scar. Three months later, local recurrence. Excision of recurrent nodules, including portions of scar. Re-examination eight months later. No recurrence.

Mikulicz's results also show the influence of the X-rays upon other than carcinoma of the skin to have been very slight. While in a few of his cases of carcinoma of the breast the disease apparently disappeared, recurrence, either local or metastatic, followed in every instance.

His conclusions are, that in carcinoma of the skin, especially *ulcus rodens*, so long as the lymphatic glands are not involved, complete cure may be effected by the use of the Röntgen rays, and that in this class of cases the X-ray treatment is of equal value to that of operation, and perhaps even superior, in view of the better scar resulting after the X-ray treatment. He would, however, exclude the treatment in the more deep-seated operable growths, while in the inoperable cases he thinks improvement with a chance of cure may result from the combined preliminary operative and subsequent X-ray treatment.

As regards operable cancer of the breast, he believes these cases should never, even under most favorable circumstances, be subjected to X-ray treatment, since here all depends upon attacking the entire lymphatic region; and while the knife may accomplish this, he knows of no case in which the X-rays have been successfully employed. The Röntgen-ray treatment should be strictly confined to inoperable cases, in which it may cause improvement, though hardly ever a cure.

There is a possibility that the case of large fibrosarcoma of the abdomen treated by Skinner, of New Haven, may prove the single exception to the rule of recurrence after X-ray treatment. The history of this case is so remarkable that it merits a brief *résumé*:

M. G. H., female, thirty-four years old, was referred to me by Dr. Maurice H. Richardson, of Boston, on April 19, 1901. She had been operated upon three years before for what was supposed to be a fibro-adenoma of the uterus; tubes and ovaries were removed. No microscopical examination was made. Two months prior to her coming to me, she had noticed a large tumor in the lower part of the abdomen in the region of the cicatrix. Physical examination at that time showed a tumor the size of a cocoanut in the lower part of the abdomen, filling up the entire iliac fossa extending nearly to the umbilicus, two inches beyond the median line to the left. The tumor was firmly fixed and seemed to involve the abdominal wall. An incision was made under cocaine, and a portion of the growth, which infil-

trated all the muscles of the abdominal wall, was removed, and on microscopical examination proved to be fibrosarcoma I used the crysipelas and *Bacillus prodigiosus* toxins more or less constantly until January, 1902, at first with marked diminution in the size of the tumor, but later with very little effect, and, finally, the tumor began to grow in size very rapidly. I regarded the case as entirely hopeless. The patient had lost much weight and had begun to be cachectic. The X-ray treatment was begun by Dr. Clarence E. Skinner, of New Haven, on January 28, 1902. Forty-six applications were given up to June 5, by which time the lateral circumference of the tumor had increased from thirteen and three-quarters to fifteen inches. She had had several attacks of fever lasting for a few days, with symptoms of toxæmia, probably from absorption. Her general health, however, improved considerably during this time. From June to September she received thirty-one treatments, and during this time there was so much local and general improvement that she decided to resume her work as a school-teacher. Up to April 25, 1903, or 234 days, she received forty-six treatments, or about one treatment in five days. There was a marked decrease in the size of the tumor. From April 25 to August 29, 1903, she received only eight treatments, or one every two weeks. She had gained eleven pounds since the beginning of the treatment. From August, 1903, till May 20, 1904, she received only five treatments, or one every thirty-seven days. By this time her weight had increased to 147 pounds, being nineteen pounds more than in the beginning, and the tumor had entirely disappeared. In July, 1904, I examined the patient and was unable to detect any evidence of a tumor. The entire period of treatment extended over 849 days, during which time 136 treatments were given.

While it is true that only one year has elapsed since the cessation of the treatment and disappearance of the tumor, it is nevertheless the most remarkable case on record, I think, considering the very large size of the growth and its deep-seated location, although, of course, it is quite too soon to consider it a cure.

In a letter dated June 4, 1905, the patient states that she is in perfect health, and has had no return of the tumor.

In the last report of the Caroline Brewer Croft Cancer Commission of the Harvard Medical School, Vose and Howe present a careful *résumé* of the effects of the X-ray upon cancer, their investigations being based upon a study of 120 cases treated chiefly at the Massachusetts General Hospital of Boston.

In regard to deep-seated cancer, they fail to report a single case, carcinoma or sarcoma, that has thus far disappeared. They conclude that, being non-selective in its action, the X-ray cannot be used strongly enough to effect destruction in anything but the shallowest tumor without serious injury to the overlying tissue, or, in other words, producing such a burn as experience shows in all probability would never heal.

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Of late the use of the X-ray as a pre-operative measure has been strongly advocated by a number of men, especially by Dr. Morton, of New York. It is held that in cases of cancer in the early stages, particularly in small primary cancer of the breast, instead of advising immediate surgical intervention, the patient had better first be treated by the X-ray. The reasons for this plan are (1) that the X-ray treatment clears up the field of operation, *i.e.*, causing the glands in the axilla to subside or disappear and making the tumor itself smaller. If, at the end of four to five weeks of treatment, the growth has not entirely disappeared, an operation can then be performed, and performed under more favorable conditions than if the X-ray treatment had not first been used.

This plan of procedure I believe to be most pernicious and fraught with grave peril to the patient, if it should ever be considered seriously by the profession. The fallacy of such reasoning is twofold: (1) it presupposes that we are dealing

with a curative agent, and (2) it takes for granted that no harm can come to the patient by reason of the delay entailed in a trial with the treatment.

Now let us look at the facts: Has it yet been demonstrated that the X-ray is curative of cancer in any other form than the small superficial epitheliomas? As far as our own experience goes, extending over a series of 167 cases, and as far as can be judged from the published reports of the work of other men, there have been very few cases of deep-seated cancer, including sarcoma, that have disappeared under X-ray treatment; and there is at the present time no evidence that in a single case of deep-seated cancer in which the tumor disappeared, the patient remained well and free from a local or general return for a period of three years, the shortest time required to warrant us in speaking of a cure. On the other hand, we do know from experience that in practically all of the cases in which tumors have disappeared there has been a speedy recurrence.

This to prove that we are dealing with an agent that has given us no reason, so far, to call curative.

(2) The danger of postponing operative treatment until the X-ray has been tried is lost sight of. I have personally seen a number of cases of primary or recurrent cancer of the breast markedly decrease in size under X-ray treatment and, in some instances, altogether disappear at the very time when the disease was insidiously extending into neighboring glandular areas, the cervical or mediastinal glands, or was being carried by the circulation into the general system, giving rise to fatal metastases. In these cases the extension was so rapid that I believe the breaking down of the tumor tissue, which occurs before absorption takes place, carries with it the serious risk of some of the living cells getting into the circulation, thereby causing generalization of the disease. The experiments upon cancer in mice carried on by Drs. Park, Gaylord, and Clowes at the Cancer Research Laboratory in Buffalo tend to support this opinion.

The prolonged use of the X-rays in cases of recurrent

cancer of the breast, as well as in a number of cases of recurrent cancer of the tongue and lip, has shown practically little or no effect upon the invaded glands; they neither disappeared nor decreased materially in size.

Now suppose the X-ray treatment were tried for a few weeks before operation. Three things may occur:

1. The diagnosis may be quite uncertain without removal and microscopical examination of the tissue; hence, the result, if the tumor disappears and the patient remains without further trouble, cannot be put in the same category as a cure from operative treatment, in which the diagnosis has been confirmed by the microscope.

2. Granting the correctness of the diagnosis and the tumor disappears under the treatment, such a result, while possible, from our present experience, is extremely unlikely to occur. Of forty-three cases of malignant tumors, even including superficial epitheliomas, reported by Skinner, whose enthusiasm in behalf of X-ray treatment cannot be doubted, only three entirely disappeared, or 7 per cent.; and a much smaller percentage would be found if dealing with deep-seated cancer alone. Of my own breast cases, thirty-six in number, only one disappeared, and this was quickly followed by a recurrence and extension into lung.

If, however, the tumor should disappear, the patient, believing herself cured, returns to her home, and before any local recurrence has taken place the disease may appear in the axillary, cervical, or mediastinal glands, or there may be metastatic deposits in the lung or liver, thus placing the patient beyond help from either X-ray or surgery.

3. Suppose the growth to have diminished in size and then to have shown no further improvement. Such a case is said to be in better condition for operation than before the X-ray treatment. But is such the case? The very fact that the tumor has diminished in size or the glands are smaller would tend to restrict the field of operation and lead the surgeon to remove less tissue than he otherwise would have done. But above and beyond all other considerations, in my

estimation, is the fact that tumor degeneration caused by the X-ray carries with it the risk of living cancer-cells being carried into the neighboring glands and of entering the circulation, causing metastases.

The following case which has recently come under my observation, and which can, no doubt, be duplicated by many surgeons, furnishes striking evidence of the dangers to the patient in the pre-operative use of the X-ray in primary operable growths.

Epithelioma of the Lip.—A man, aged fifty years, noticed a small epithelioma of the lip in the spring of 1903, about the size of a small bean. He was advised to have X-ray treatment rather than operation, and after thirteen exposures the tumor had apparently entirely disappeared and the patient was discharged cured. Less than six weeks after this time, a local recurrence was noticed, when again the X-ray treatment was taken up. At this time the X-rays had apparently no effect upon the growth of the tumor, which continued to increase in size rapidly in spite of frequent treatments, and, finally, three months later he was sent to me for operation. His condition at this time was as follows: There was a typical ulcerating epithelioma involving more than half of the lower lip, and, in addition, the sublingual and submaxillary glands were extensively involved. I performed a very extensive operation, removing three-quarters of the lower lip and the glands as carefully as possible, but with little hope of radical cure. About six months later there was a recurrence in the cervical glands.

When we consider that epithelioma of the lip in its earlier stages furnishes the largest percentage of cures of any locality, about 50 per cent., it is fair to infer that in this case the patient's life was probably sacrificed owing to the loss of time incurred by the pre-operative use of the X-ray.

I have recently examined a man aged sixty years, who, about a year ago, was treated with the X-ray for a small epithelioma of the tongue, receiving fifty-two treatments in all, with the result that the disease now involves the entire

anterior half of the tongue, floor of mouth, submaxillary and sublingual glands, the growth being firmly adherent to the bone.

CONCLUSIONS.

The results of the X-ray treatment of malignant tumors up to the present time have proven

I. That the X-ray exerts a powerful influence upon cancer cells of all varieties, but most marked in cases of cutaneous cancer.

II. In some cases, chiefly in superficial epithelioma, the entire tumor may disappear, probably by reason of fatty degeneration of the tumor cells with subsequent absorption.

III. In a much smaller number of cases of deep-seated tumors, chiefly cancer of the breast and glandular sarcoma, tumors have disappeared under prolonged X-ray treatment. In nearly every one of these cases, however, that has been carefully traced to final result, there has been a local or general return of the disease within a few months to two years.

IV. In view of this practically constant tendency to early recurrence, furthermore, in the absence of any reported cases well beyond three years, the method should never be used except in inoperable cases, or as a prophylactic after operation, as a possible, though not yet proven, means of avoiding recurrence.

V. The use of the X-ray as a pre-operative measure in other than cutaneous cancer is contraindicated, 1, because the agent has not yet been proven to be curative; 2, because of serious risks of an extension of the disease to inaccessible glands or to other regions by metastases during the period required for a trial of the X-ray.